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<b>(21) International Application Number:</b> PCT/GB95/02830 <b>(22) International Filing Date:</b> 5 December 1995 (05.12.95) <b>(30) Priority Data:</b> 9424562.8 6 December 1994 (06.12.94) GB <b>(71) Applicant (for all designated States except US):</b> GILTECH LIMITED [GB/GB]; 9/12 North Harbour Estate, Ayr KA8 8AA (GB). <b>(72) Inventors; and</b> <b>(75) Inventors/Applicants (for US only):</b> GILCHRIST, Thomas [GB/GB]; 67 Midton Road, Ayr KA7 2TW (GB). GILCHRIST, Eilidh [GB/GB]; 11 Monkton Road, Prestwick KA9 1AP (GB). <b>(74) Agent:</b> MURGITROYD & COMPANY; 373 Scotland Street, Glasgow G5 8QA (GB).		<b>(81) Designated States:</b> AL, AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TT, UA, UG, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, LS, MW, SD, SZ, UG).  <b>Published</b> <i>With international search report.</i>
<b>(54) Title:</b> FOAMABLE FORMULATION AND FOAM  <b>(57) Abstract</b>  There is described a foamable formulation comprising a foamable carrier and an active ingredient which may be admixed with the carrier or packaged separately and dispersed into the carrier during the foaming process. Alginate gel is a preferred foamable carrier. The foam produced from such a formulation, and a foam sheet produced by drying the foam, also form part of the invention. The formulation, foam and foam sheet are especially useful for medical applications, for example in treating burns. An apparatus to store the components of the formulation and to generate the foam is also described.		

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1     **"Foamable Formulation and Foam"**

2

3     The present invention is concerned with a foamable  
4     formulation and the foam formed therefrom.

5

6     A wide variety of gels, creams, ointments, lotions etc  
7     are available for application to a body surface. The  
8     exact content of such compositions generally depends  
9     upon the purpose of application which may be, for  
10    example, to clean a body surface, to promote healing of  
11    any wound or injury, to prevent an exposed area of the  
12    body from drying out, to prevent infection etc. In  
13    certain circumstances the composition may include an  
14    active ingredient which is administered to the patient  
15    by application of the composition.

16

17    One example of a commercially available gel in  
18    INTRASITE™ produced by Smith & Nephew Ltd. This  
19    hydrogel contains hydrated carboxymethylcellulose as  
20    its main ingredient, and is applied to wounds in gel  
21    form as a primary treatment in order to clean the  
22    exposed surface by aiding removal of cell debris, dirt  
23    etc. In addition to acting as a sloughing agent, the  
24    gel also keeps the wound from drying out, thereby  
25    promoting healing.

1 Another example of a gel suitable for use on a wound  
2 dressing is described in EP-A-0586260 of Courtaulds  
3 Fibres Ltd. The gel disclosed is an alginate gel  
4 having an alginate content of 2 to 11 percent by  
5 weight.

6  
7 Viewed from one aspect, the present invention provides  
8 a formulation for application to a body surface as a  
9 foam, said formulation comprising an active ingredient  
10 and a foamable, preferably physiologically acceptable,  
11 carrier. The active ingredient(s) may be present as an  
12 integral part of the formulation, or may be held  
13 separately to other ingredients of the formulation,  
14 being combined therewith during formation of the foam.  
15 Optionally, the formulation may also comprise a foaming  
16 agent (for example a surfactant) which is capable of  
17 promoting production of a foam structure.

18  
19 In one embodiment, the present invention provides a,  
20 physiologically acceptable (preferably pharmaceutically  
21 acceptable), foamable carrier and an active ingredient  
22 packaged separately thereto which is admixed with the  
23 foamable carrier during the foaming process.

24  
25 The term "active ingredient" is used herein to refer to  
26 any agent which affects the metabolism or any metabolic  
27 or cellular process of the patient (including growth  
28 factors nutrients and living cells), promotes cleaning  
29 of the area to which it is applied (for example aids  
30 removal of a debris, dirt, bacteria, malodours and the  
31 like), combats infection, hypergranulation,  
32 inflammation and/or aids healing.

33  
34 The term "foamable carrier" refers to any ingredient  
35 which is compatible with the active ingredient and  
36 which is capable of forming a foam. Conveniently the

1 foamable carrier does not affect the function of the  
2 active ingredient in a detrimental manner. Desirably  
3 the foamable carrier is non-irritant when maintained in  
4 contact with a body surface for several hours. The  
5 foamable carrier may be a gel, for example an alginate  
6 gel.

7  
8 The foam produced may be maintained on the body area,  
9 to form a protective covering, for example over a  
10 wound. Additionally, the foam may deliver the active  
11 ingredient, preferably in a controlled release manner.  
12 In one embodiment the foam acts as a transdermal  
13 delivery system. The foam may be exposed to the  
14 atmosphere so that it dries into a coating, or may be  
15 covered by conventional dressings.

16  
17 As an example, the foam may be used to treat  
18 dermatological conditions (including psoriasis, atopic  
19 and allergic eczema). It may be convenient in this  
20 embodiment for the foam to deliver an active ingredient  
21 normally used to alleviate such conditions, for example  
22 a steroid such as hydrocortisone.

23  
24 In another embodiment the foam may be used to treat  
25 burns or scalds, including sunburn.

26  
27 In another embodiment the foam may be applied  
28 cosmetically, and for example may include skin  
29 moisturising agents, nutritional agents and growth  
30 factors suitable to promote skin regeneration. A foam  
31 intended for cosmetic use may include colorants or  
32 pigments so that the foam may be applied to the skin as  
33 a cosmetic or to disguise any blemishes in the skin.

34  
35 The foam may be used prophylactically. In particular a  
36 foam containing a UV blocking agent may be applied to

1 exposed areas of the skin to protect it from the  
2 effects of the sun.

3  
4 The formulation of the invention is applied to the body  
5 site of interest in the form of a foam and it is  
6 therefore essential that the composition undergoes a  
7 foaming process before application to the body. In the  
8 foaming process gas is forced into or is formed within  
9 the formulation to entrap small bubbles of gas therein,  
10 thereby forming the foam. Any suitably gas or gas  
11 producing system can be used to produce the foam.  
12 Mention may be made of butane and nitrous oxide, but  
13 other gases are also suitable. Conveniently the foam  
14 may be produced by conventional means such as by using  
15 aerosol technology.

16  
17 The formulation according to the present invention may  
18 be stored in any convenient container until required.  
19 Generally, the container will be designed to preserve  
20 the sterile nature of the formulation. Conveniently  
21 the container will be provided with means to foam the  
22 composition when required.

23  
24 Thus the present invention also provides an apparatus  
25 which produces a physiologically acceptable foam as  
26 described above. Generally, the foam will be produced  
27 from sterile ingredients.

28  
29 Viewed from another aspect, the present invention  
30 provides a closed container, containing therein a  
31 formulation as described above, said container being  
32 capable of expelling said formulation in the form of a  
33 foam. For example, the container may be an aerosol  
34 canister, containing a pressurized gas which in use  
35 causes production of the foam. Alternatively, the gas  
36 may be produced by a chemical reaction when two

different ingredients (for example contained in two portions of a sachet) are admixed together. In one embodiment the closed container has separate reservoirs for the foamable carrier and the active ingredient. Thus, the foamable carrier and the active ingredient are stored separately during storage and are admixed together in suitable proportions during the foaming process.

The present invention thus provides an apparatus to produce a foam for application to a body surface, from a formulation as defined above, said apparatus comprising:

a. a closed container having

i) a reservoir containing said foamable carrier;

ii) a reservoir containing said active ingredient; and

b. foaming means to produce a foam from said foamable carrier.

Optionally a foaming agent may be mixed with the foamable carrier.

Prior to the foaming process, the foamable carrier is preferably in the form of a gel. The gel may be sterilised and this is generally desirable where the foam is intended for medical use. Usually, sterilisation will take place by autoclaving the formulation, since this is currently the most economic means of achieving sterilisation. Autoclaving at temperatures of from 100°C to 125°C for under  $\frac{1}{2}$  hour is normally sufficient. Generally, the autoclaving

1 process should be as mild as possible, whilst being  
2 sufficient to sterilise the formulation. For example,  
3 autoclaving at temperatures of about 121°C for 15-20  
4 minutes is acceptable. The autoclaved formulation may  
5 then be foamed when cool. It is also possible,  
6 however, to sterilise the formulation by other means,  
7 for example by  $\gamma$ -irradiation or e-beam irradiation. It  
8 has been found that autoclaving the gel may cause the  
9 MW of the foamable carrier to be slightly reduced.  
10 Consequently it may be desirable to select a foamable  
11 carrier having a higher MW than that ultimately  
12 required.

13  
14 The foam forms an air-tight cover around any wound or  
15 injury to which it is applied, and this prevents that  
16 area from drying out and may also combat infection.  
17 The advantages of applying a topical product in the  
18 form of a foam include:

- 19  
20 1. Easy rapid application,  
21 2. Conforms to surface irregularities,  
22 3. Insulates the wound,  
23 4. Cools the tissues,  
24 5. Offers antibacterial action to prevent  
25 infection,  
26 6. Biocompatibility with tissue,  
27 7. Suitable for use as a vehicle for the  
28 administration of pharmaceutical agents,  
29 and/or  
30 8. Maintains a moist environment.

31  
32 It has been observed that the foam produced from the  
33 formulation of the present invention may subside over a  
34 period of time (for example 3 to 24 hours, especially 6  
35 to 12 hours) as some of the gas entrapped in the foam  
36 structure escapes. The foamed formulation gradually



1 dries to produce a foam (i.e. closed cell) sheet which  
2 still retains a basic foam structure and which may  
3 cover the site to which the foam was applied. This  
4 foam sheet can be left in place as a protective cover  
5 over a wound, may be used to deliver an active  
6 ingredient to the site, etc. It is possible to produce  
7 the sheet separately as a dressing for a wound or  
8 injury for direct application in that form. The foam  
9 sheet is therefore a yet further aspect of the present  
10 invention.

11  
12 Generally, the formulation of the present invention  
13 will be applied directly to the body site of interest  
14 in the form of a foam, the foam being produced from any  
15 suitable device (such as an aerosol) immediately before  
16 application. It is, however, possible for a quantity  
17 of the foamed formulation to be produced and then  
18 applied onto the body site by any suitable means, for  
19 example by hand or by spatula. This method may be  
20 required for wounds having a narrow opening.

21  
22 As stated above, the foam may also be produced on a  
23 suitable surface and then dried to produce the foam  
24 sheet described above. Generally, the production of  
25 the sheet will take place under sterile conditions.  
26 The sheet may be divided into a convenient size and may  
27 be packaged. Optionally the foam sheet may be produced  
28 on contoured surface so that it is moulded to a pre-  
29 determined shape.

30  
31 It has further been observed that where the foam is  
32 covered with an airtight cover (for example a plastics  
33 backing) the foam structure is maintained, without  
34 collapsing to a foam sheet. Covering the freshly  
35 produced foam with a plastics cover (for example a  
36 plastics film or a plastics bag) may be desirable in

1 circumstances where the bulk of the foam is to be  
2 retained.

3  
4 Examples of suitable foamable carriers for use in the  
5 composition of the present invention include (but are  
6 not limited to) alginate and derivatives thereof,  
7 carboxymethylcellulose and derivatives thereof,  
8 collagen, polysaccharides (including, for example,  
9 dextran, dextran derivatives, pectin, starch, modified  
10 starches such as starches having additional carboxyl  
11 and/or carboxamide groups and/or having hydrophillic  
12 side-chains, cellulose and derivatives thereof), agar  
13 and derivatives thereof (such as agar stabilised with  
14 polyacrylamide), polyethylene oxides, glycol  
15 methacrylates, gelatin, gums such as xanthum, guar,  
16 karaya, gellan, arabic, tragacanth and locust bean gum.  
17 Also suitable are the salts of the aforementioned  
18 carriers, for example, sodium alginate. Mixtures of  
19 any of the aforementioned carriers may also be used, as  
20 required.

21  
22 Preferred foamable carriers include alginate,  
23 carboxymethylcellulose, the derivatives and salts  
24 thereof and mixtures of any of these. Alginate (the  
25 derivatives or salts thereof, such as sodium and  
26 calcium alginate) are especially preferred. Foamable  
27 carriers having a molecular weight of from 10,000 to  
28 200,000 kDa are preferred, especially over 100,000 kDa,  
29 for example 150,000 to 200,000 kDa, may be used.

30  
31 The formulation may further comprise a foaming agent,  
32 which promotes the formation of the foam. Any agent  
33 having a surfactant character may be used. The  
34 surfactants may be cationic, non-ionic or anionic.  
35 Examples of suitable foaming agents include cetrimide,  
36 lecithin, soaps, silicones and the like. Commercially

1 available surfactants such as Tween™ are also suitable.  
2 Cetrimide (which additionally has an anti-bacterial  
3 activity) is especially preferred.

4

5 The formulation of the present invention (and thus the  
6 foam) may be used to deliver pharmaceutically active  
7 agents, in particular to deliver such agents in a  
8 controlled release manner. Mention may be made of:

9

10 Antiseptics, Antibacterials and Antifungal agents,  
11 such as Chlorhexidine, acetic acid, polynoxylin,  
12 povidone iodine, mercurochrome phenoxyethanol,  
13 acridene, silver nitrate, dyes eg brilliant green,  
14 undecanoic acid, silver sulphadiazine, silver  
15 proteins and other silver compounds,  
16 metronidazole, benzaclonium chloride;

17

18 Nutritional agents, such as vitamins and proteins;

19

20 Growth factors and healing agents, including  
21 Ketanserin a serotonomic blocking agent;

22

23 Living Cells;

24

25 Enzymes include streptokinase and streptodormase;

26

27 Elements - zinc, selenium, cerium, copper,  
28 manganese, cobalt, boron, arsenic, chromium  
29 silver, gold, gallium;

30

31 Charcoal;

32

33 Desloughing and Debriding agents such as  
34 hypochlorite and hydrogen peroxide;

35

36 Astringents including potassium permanganate;

1        Antibiotics exemplified by neomycin and framycetin  
2        sulphate, sulfamylon, fusidic acid, mupirocin,  
3        bacitracin, gramicidin.

4  
5        A particularly convenient way of presenting metal ions  
6        (for example silver or calcium ions) is via a glass  
7        composition. The glass may be ground into particle  
8        form and then incorporated into the formulation of the  
9        present invention. Optionally the glass is capable of  
10       sustained or delayed release of the metal ions.

11       Reference may be made to WO-A-90/08470 of Giltech Ltd  
12       which describes a suitable glass composition for  
13       delivering silver ions. Thus, a preferred embodiment  
14       of the invention is a formulation as described above  
15       wherein particles of a metal ion (preferably silver  
16       and/or calcium ion) releasing glass are admixed into  
17       the formulation during the foaming process.

18  
19       Other preferred pharmaceutically active agents include  
20       Chlorhexidine, povidone iodine and cetrимide.

21  
22       In addition the formulation of the present invention  
23       may further comprise other conventional additives such  
24       as plasticisers and humectants (such as glycerol,  
25       propane-1,2-diol, polypropylene glycol and other  
26       polyhydric alcohols), free radical scavengers to  
27       stabilise against the effects of sterilisation by  
28       irradiation, viscosity-adjusting agents, dyes and  
29       colorants, and the like.

30  
31       Particularly preferred formulations of the present  
32       invention include:

- 33  
34       1.    Alginate/cetrimide  
35           - alone or with chlorohexidine or povidone iodine  
36           or other agents.

Uses

- a. Hand and body washing (including scalp shampoo);
- b. Topic agents for skin carriage sites and wounds.

2. Alginate/cetrimide/calcium and silver ion releasing glass (eg Arglaes™)  
- alone or with other agents

The calcium released from the glass will stabilise the alginate by forming the insoluble calcium salt.

Uses

- a. Silver is effective against gram negative species eg Proteus, E Coli, Pseudomonas & Klebsiella aerobacters;
- b. Cetrimide is a broad spectrum antibacterial and antifungal agent, most effective against gram positive species eg Staphylococcus epiderimidis and aureus (wounds are generally infected on a 50:50 basis with gram positive or negative species); and
- c. sloughy wounds, granulating or epithelialising wounds, black necrotic tissue, clinically infected wounds, malodorous wounds and burns and scalds and as a haemostat.

3. Hydrogel foams in general

eg Carboxymethylcellulose

eg Gelatin - preformed foam could provide an

1 improved presentation for burn coverings,  
2 temporary soft tissue implants, etc.

3  
4 4. Mixtures

5 eg Alginate/collagen mixtures.

6  
7 Alginates are particularly preferred as the foamable  
8 carrier in the formulation of the present invention.  
9 Alginates are especially useful for application to  
10 wounds since the alginate promotes the healing process  
11 and is itself slowly absorbed and metabolised in the  
12 body. Sodium alginate is soluble whereas calcium  
13 alginate is insoluble. In the present invention  
14 therefore it is desirable for a careful mixture of  
15 sodium and calcium alginate to be produced, the exact  
16 ratio being altered in accordance with the desired  
17 characteristics of the foam. An alginate-based foam  
18 may therefore be easily removed simply by washing away  
19 in saline. Commercially available alginates suitable  
20 for use in the present invention include Manucol DMF,  
21 Manucol LKX, and Keltone™ for example Keltone HV™ which  
22 is a finely ground fibrous sodium alginate suitable for  
23 use in food preparations. High molecular weight  
24 alginates are preferred, for example these having a  
25 molecular weight of 50,000 kDa or above, for example  
26 100,000 to 200,000 kDa.

27  
28 The present invention further provides the use of a  
29 formulation for production of a foam suitable for  
30 medical or veterinary purposes, especially for the  
31 controlled released delivery of the active ingredient.

32  
33 For example, the present invention provides the use of  
34 a formulation to produce a foam suitable for  
35 application to wounds or injuries, especially burns.  
36 The invention further provides the use of a formulation

1 to produce a foam which delivers an active ingredient,  
2 such as a cleaning agent or a medicament to the body.  
3 For example, the foam produced may be used as a soap  
4 alternative for doctors or other medical staff to clean  
5 their hands before seeing a patient. Use of the foam  
6 could eliminate the need for washing in water.

7  
8 Additionally, the present invention provides the use of  
9 the foam itself for application (in particular topical  
10 application) to a body. Therefore the foam may be used  
11 to deliver a drug or any other medicament, may be used  
12 as a sloughing agent to clean a wound etc, or may be  
13 used to provide a sterile covering for a wound etc.

14  
15 The present invention also provides the use,  
16 separately, of the container, of the composition and of  
17 the foam described above to produce a wound dressing in  
18 the form of a foam sheet.

19  
20 In a further aspect, the present invention provides a  
21 method of treatment of the human or animal (preferably  
22 mammalian) body, said method comprising administering  
23 to said body a foam or a foam sheet as hereinbefore  
24 defined. Optionally the foam and/or foam sheet may  
25 deliver a drug or a medicament to the body.

26  
27 The foam and the foam sheet of the present invention  
28 are especially suitable for treatment of burns.

29  
30 The present invention will now be described with  
31 reference to the following examples:

32  
33 Unless otherwise stated, the percentage amounts of  
34 ingredients are given on a percentage by weight basis.

35

36

1     Example 1

2

3     A composition according to the present invention was  
4     formed by admixing the following ingredients together:

5

6             3% Manucol LKX

7             1% Cetrimide

8             80:20 di-ionised water : propan-1,2-diol

9             3% Arglaes (a silver ion releasing glass)

10

11     A gel composition was formed and autoclaved at  
12     approximately 121°C for 15 to 20 minutes. The gel  
13     produced was firm but mobile.

14

15     The gel was foamed using an aerosol canister and a fine  
16     celled, highly conformable, thick, creamy foam was  
17     produced. There was little slump, little flow, fairly  
18     stable, did not go back to a gel when rubbed. The foam  
19     was cool and soothing. Once left to dry the flat foam  
20     left is still moist, cool sponge. The silver presence  
21     was showing.

22

23     Example 2

24

25     A composition according to the present invention was  
26     formed by admixing the following ingredients together:

27

28             3% Manucol DMF

29             1% Cetrimide

30             80:20 di-ionised water : propan-1,2-diol

31

32     A gel composition was formed and autoclaved at  
33     approximately 121°C for 15 to 20 minutes. The gel  
34     produced was firm but mobile.

35

36     The gel was foamed using an aerosol canister and a fine



1 celled, highly conformable, thick foam was produced.  
2 There was no slump or flow. The foam was very stable  
3 and did not go back to a gel when rubbed. It was cool  
4 and soothing. Once left to dry the flat foam left was  
5 still moist, fragile and sponge-like.

6

7 Example 3

8

9 A composition according to the present invention was  
10 formed by admixing the following ingredients together:

11

12 3% Keltone

13 1% Cetrimide

14 80:20 di-ionised water : glycerol

15

16 A gel composition was formed and autoclaved at  
17 approximately 121°C for 15 to 20 minutes. The gel  
18 produced was firm but mobile.

19

20 The gel was foamed using an aerosol canister and a fine  
21 celled, thick foam was produced. There was no slump or  
22 flow. The foam was very stable, had a dry feeling,  
23 plasticity, and did not go back to a gel when rubbed.  
24 It was cool and soothing. Once left to dry the flat  
25 foam was still moist, fragile and sponge-like.

26

27 Example 4

28

29 A composition according to the present invention was  
30 formed by admixing the following ingredients together:

31

32 350mls di-ionised water

33 2gms Cetrimide

34 20gms Carboxymethylcellulose

35 40mls Glycerin

36

1 A gel composition was formed. The gel produced was  
2 very sticky.

3  
4 The gel was foamed using an aerosol canister and a  
5 thixotropic, minimum flow, fine cellular foam was  
6 formed. It had a thick texture that was virtually  
7 unchanged when left overnight.

8

9 Example 5

10

11 A composition according to the present invention was  
12 formed by admixing the following ingredients together:

13

14 80mls di-ionised water  
15 2gms Cetrimide  
16 20mls Glycerin  
17 4gms Carrageenan

18

19 A gel composition was formed. The gel produced was  
20 thick and foamed slightly when cetrimide was added  
21 (acts like an alginate).

22

23 The gel was foamed using an aerosol canister and a  
24 thixotropic, minimum flow, fine cellular foam was  
25 formed. It did not collapse to touch and was difficult  
26 to break down into a gel again. After being left  
27 overnight it was sticky and non-cohesive.

28

29 Example 6

30

31 A composition according to the present invention was  
32 formed by admixing the following ingredients together:

33

34 60mls di-ionised water  
35 1.2gms Cetrimide  
36 4mls Gelatin

1 A gel composition was formed. The gel produced was  
2 firm and rigid. Just before foaming 60 mls boiling di-  
3 ionised water was added and a warm liquid was formed.  
4 When pressurised the temperature dropped.

5  
6 After the liquid reached the correct temperature within  
7 the foaming canister a thick fully expanding foam was  
8 produced. It was fine celled and did not break down  
9 easily. Initially it was non-thixotropic and then  
10 developed into a stable foam. Overnight a firm closed  
11 cell sponge with very good handling strength was  
12 produced.

13  
14 Example 7

15  
16 A composition according to the present invention was  
17 formed by admixing the following ingredients together:

18  
19 80mls di-ionised water  
20 1ml Tween 80  
21 3gms Keltone  
22 20mls glycerin

23  
24 A gel composition was formed. The gel produced was  
25 firm but mobile.

26  
27 The gel was foamed using an aerosol canister and a fine  
28 celled, thick, thixotropic foam was produced that  
29 stabilised very quickly.

30  
31 Example 8

32  
33 A composition according to the present invention was  
34 formed by admixing the following ingredients together:

35  
36 3% Keltone

1           1% Cetrimide  
2           80:20 di-ionised water : glycerol  
3           4% povidone iodine  
4

5       A gel composition was formed and autoclaved at  
6       approximately 121°C for 15 to 20 minutes. The gel  
7       produced was firm but mobile.  
8

9       The gel was foamed using an aerosol canister and a fine  
10       celled, thin foam was produced that stabilised  
11       overnight into a sponge with good handling strength.  
12

13       Example 9

14       A composition according to the present invention was  
15       formed by admixing the following ingredients together:  
16

17           3% Keltone  
18           1% Cetrimide  
19           80:20 di-ionised water : glycerol  
20

21       A gel composition was formed and autoclaved at  
22       approximately 121°C for 15 to 20 minutes. The gel  
23       produced was firm but mobile.  
24

25       Just before foaming 6g Arglaes powder (ie powdered  
26       metal ion releasing glass) was added and the gel was  
27       immediately foamed using an aerosol canister. A fine  
28       celled, white foam was produced that eventually  
29       stabilised into a firm sponge pad.  
30

31       Example 10

32  
33       A composition according to the present invention was  
34       formed by admixing the following ingredients together:  
35

36           3% Keltone

1           1% Cetrimide  
2           80:20 di-ionised water : glycerol  
3           0.1g Chlorohexidine

4  
5       A gel composition was formed and autoclaved at  
6       approximately 121°C for 15 to 20 minutes. The gel  
7       produced was firm but mobile.

8  
9       The gel was foamed using an aerosol canister and a fine  
10      celled, thick foam was produced that stabilised  
11      overnight into a sponge pad.

12  
13      Example 11

14      A composition according to the present invention was  
15      formed by admixing the following ingredients together:

16  
17           2½% Keltone  
18           2½% Carboxymethylcellulose  
19           1% Cetrimide  
20           80:20 di-water : glycerol

21  
22      The gel composition formed was autoclaved at  
23      approximately 121°C for 15 to 20 minutes. The gel  
24      produced was firm but mobile.

25  
26      The gel was foamed using an aerosol canister and a fine  
27      celled, highly conformable, foam was produced. There  
28      was little slump or flow, the foam was fairly stable,  
29      cool and soothing. Once left to dry the flat foam  
30      sheet was a still moist, cool sponge.

31  
32      Example 12

33  
34      A composition according to the present invention was  
35      formed by admixing the following ingredients together:

36

- 1           2% Keltone
- 2           2% Hydroxypropylcellulose
- 3           1% Cetrimide
- 4           80:20 di-water : glycerol

5

6           The gel composition formed was autoclaved at  
7           approximately 121°C for 15 to 20 minutes. The gel  
8           produced was thick but mobile.

9

10          The gel was foamed using an aerosol canister and a fine  
11          celled foam was produced. There was little slump or  
12          flow, the foam was fairly stable, cool and soothing.  
13          Once left to dry the flat foam sheet was a still moist,  
14          cool sponge.

1     CLAIMS

- 2
- 3     1.     A formulation for application to a body surface as  
4           a foam, said formulation comprising, in admixture  
5           or separately, a physiologically acceptable  
6           foamable carrier and an active ingredient.  
7
- 8     2.     A formulation as claimed in Claim 1 wherein said  
9           active ingredient is packaged separately to said  
10          foamable carrier prior to foaming.  
11
- 12    3.     A formulation as claimed in either one of Claims 1  
13          and 2 wherein said foamable carrier is alginate,  
14          carboxymethylcellulose, collagen, a  
15          polysaccharide, agar, a polyethylene oxide, a  
16          glycol methacrylate, gelatin, a gum, or salts or  
17          derivatives of any of these, or mixtures thereof.  
18
- 19    4.     A formulation as claimed in Claim 3 wherein said  
20          foamable carrier is alginate, carboxymethyl-  
21          cellulose, the derivatives or salts thereof, or  
22          mixtures thereof.  
23
- 24    5.     A formulation as claimed in any one of Claims 1 to  
25          4, wherein said foamable carrier has a molecular  
26          weight of from 10,000 to 200,000 kDa.  
27
- 28    6.     A formulation as claimed in any one of Claims 1 to  
29          5, wherein said active ingredient is a silver ion  
30          releasing glass composition, chlorhexidine,  
31          povidone iodine or cetrимide.  
32
- 33    7.     A formulation as claimed in any one of Claims 1 to  
34          6 further containing a foaming agent.  
35
- 36    8.     A formulation as claimed in Claim 7 wherein said

1           foaming agent is cetrimide, lecithin, a soap,  
2           silicone, a surfactant or the like.

3

4       9.   A formulation as claimed in any one of Claims 1 to  
5           8 in foamed form, wherein said active ingredient  
6           is evenly distributed throughout the foam.

7

8       10.  A formulation as claimed in any one of Claims 1 to  
9           9 in the form of a foam sheet.

10

11       11.  An apparatus to produce a foam for application to  
12           a body surface, from a formulation as claimed in  
13           any one of Claims 1 to 9, said apparatus  
14           comprising:

15

16           a.   a closed container having

17

18                   i)   a reservoir containing said foamable  
19                   carrier;

20

21                   ii) a reservoir containing said active  
22                   ingredient; and

23

24           b.   foaming means to produce a foam from said  
25           foamable carrier.

26

27       12.  An apparatus as claimed in Claim 11 wherein said  
28           foamable carrier and said active ingredient are  
29           admixed together and contained within the same  
30           reservoir.

31

32       13.  An apparatus as claimed in Claim 11 wherein said  
33           foamable carrier and said active ingredient are  
34           contained in separate reservoirs, and wherein said  
35           apparatus includes means to evenly disperse active  
36           ingredient into the foam.



- 1      14. An apparatus as claimed in any one of Claims 11 to  
2            13 wherein said foaming means is an aerosol  
3            canister.  
4  
5      15. Use of a formulation as claimed in any one of  
6            Claims 1 to 10 for medical or veterinary purposes.  
7  
8      16. Use of a formulation as claimed in any one of  
9            Claims 1 to 10 as a delivery system for the  
10           controlled release of said active ingredient.  
11  
12     17. Use of a foamed formulation as claimed in Claim 9  
13           or a foam sheet as claimed in Claim 10 as a wound  
14           dressing.  
15  
16     18. A method of treatment of the human or animal body,  
17           said method comprising administering to said body  
18           a foamed formulation as claimed in Claim 9 or a  
19           foam sheet as claimed in Claim 10.  
20  
21     19. A method as claimed in Claim 18 wherein said  
22           foamed formulation or said foam sheet delivers  
23           said active ingredient to said body in a  
24           controlled release manner.  
25  
26     20. A method as claimed in either one of Claims 18 and  
27           19 for treating burns or scalds.  
28  
29  
30

# INTERNATIONAL SEARCH REPORT

International Application No  
**PCT/GB 95/02830**

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 A61K9/12

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DATABASE WPI Week 9247 Derwent Publications Ltd., London, GB; AN 92-384885 & JP,A,04 282 311 (KOIKE KAGAKU) see abstract	1,3,6-9, 15-20
Y	---	3,4,6,10
Y	GB,A,2 207 865 (BIOGAL GYOGYSZERGYAR) 15 February 1989 see claims 1,5,6 see examples 1,2 ---	3,4
	-/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
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- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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Date of the actual completion of the international search

28 February 1996

Date of mailing of the international search report

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# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/GB 95/02830

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>DATABASE WPI  Week 9113  Derwent Publications Ltd., London, GB;  AN 91-092231  &amp; JP,A,03 038 504 (SHINGAWA NENRYO)  see abstract  -----</p>	6,10

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 95/02830

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A-2207865	15-02-89	AU-B- 612387	11-07-91
		AU-B- 2038788	09-02-89
		BE-A- 1001932	17-04-90
		BG-A- 49522	16-12-91
		CH-A- 675833	15-11-90
		DE-A- 3826419	16-02-89
		FR-A- 2619011	10-02-89
		JP-A- 1117828	10-05-89
		NL-A- 8801930	01-03-89
		SE-A- 8802805	05-02-89
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